

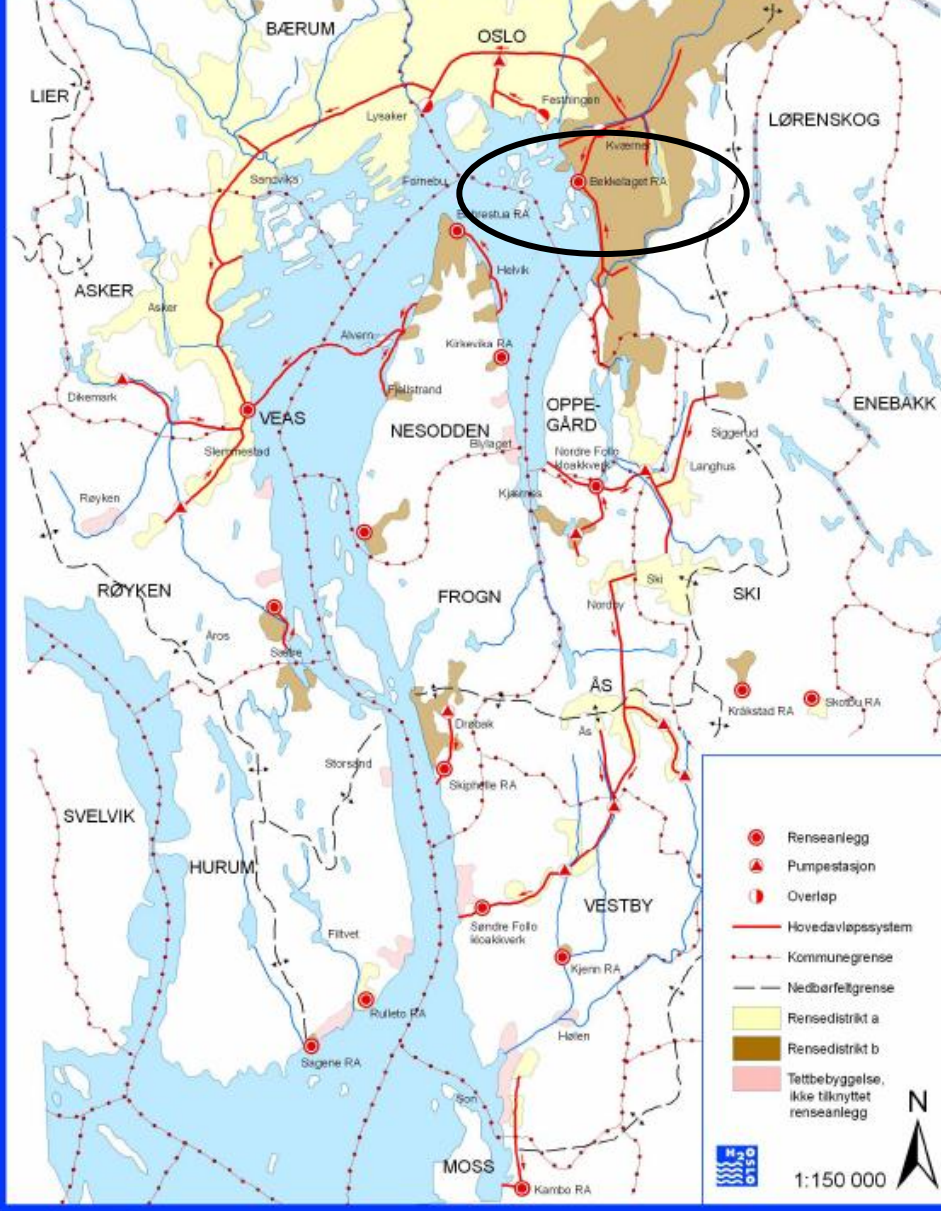
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Thermophilic anaerobic digestion – full scale operational data from Bekkelaget WWTP in Oslo, Norway

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HOVEDAVLØPSSYSTEMET FOR INDRE OSLOFJORD



FACTS:

- 35-40% of all wastewater from Oslo is treated at Bekkelaget WWTP
- New plant put in operation in 2000
- Owned by the City of Oslo, operated by the private company Bekkelaget Water Inc. (BEVAS)
- Designed for 280.000 pe, existing load 290 000 pe
- Average daily flow ~139.000 m³/d = 1.6 m³/sec
- Discharge requirements:
P-removal > 90%
N-removal > 70%
(including overflow)
- Sludge production: ~5.900 tons DS/year
- Gas production: 3.700.000 Nm³/year

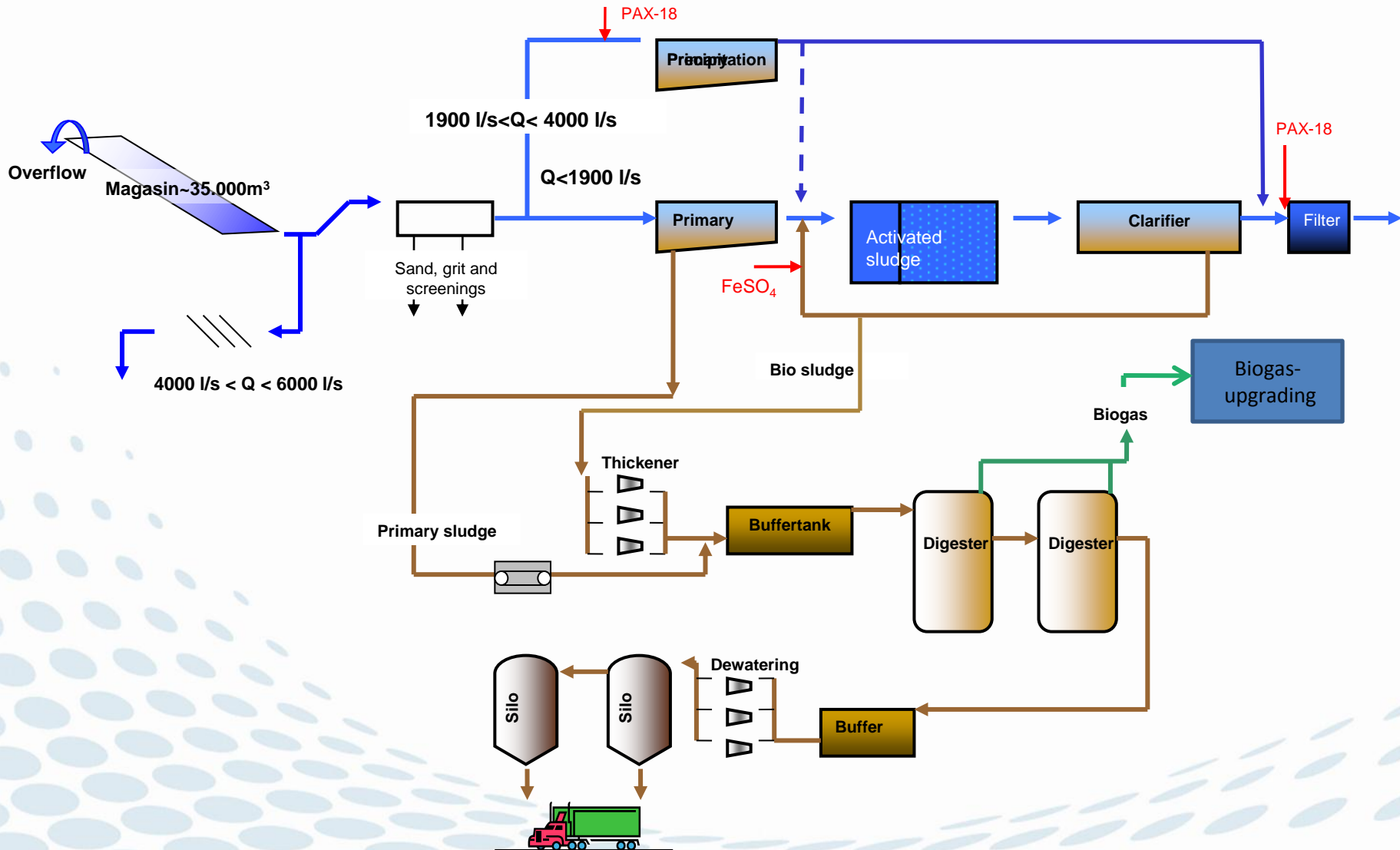


**Gas holder and
Upgrading plant**

Rock caverns

Admin building

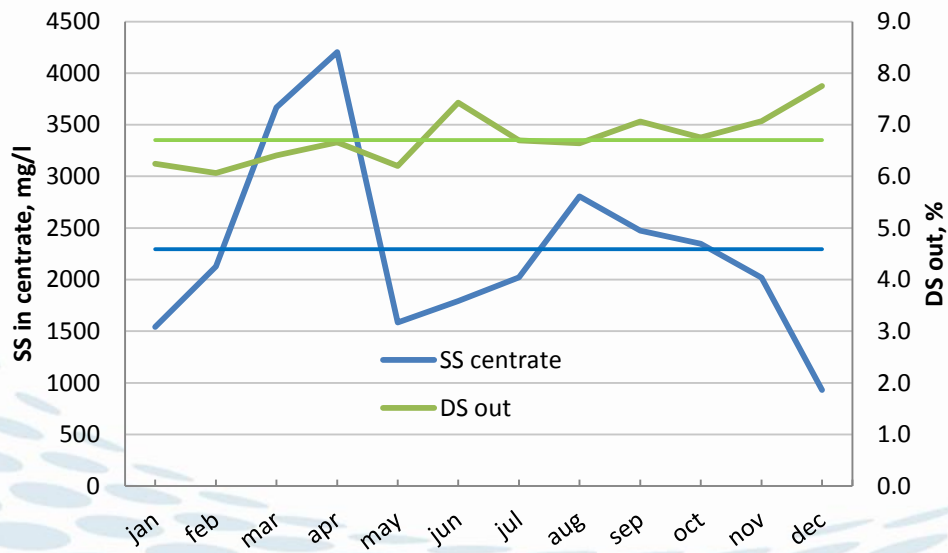
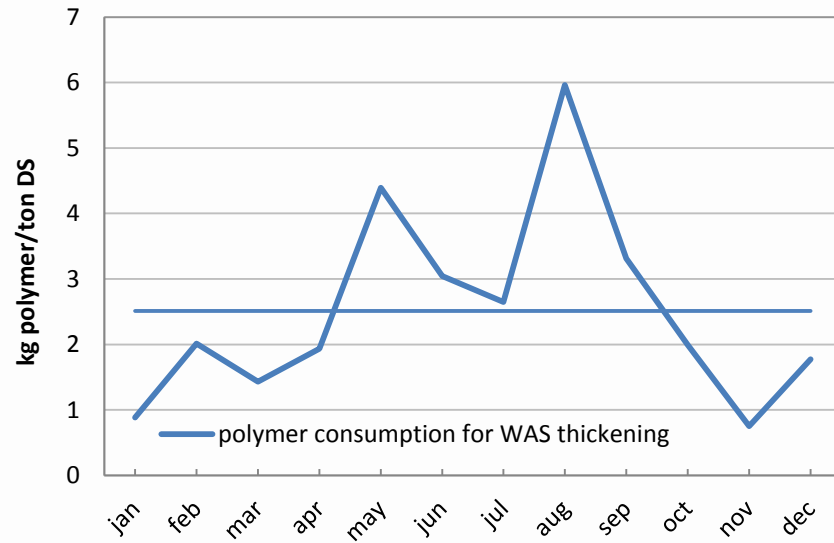
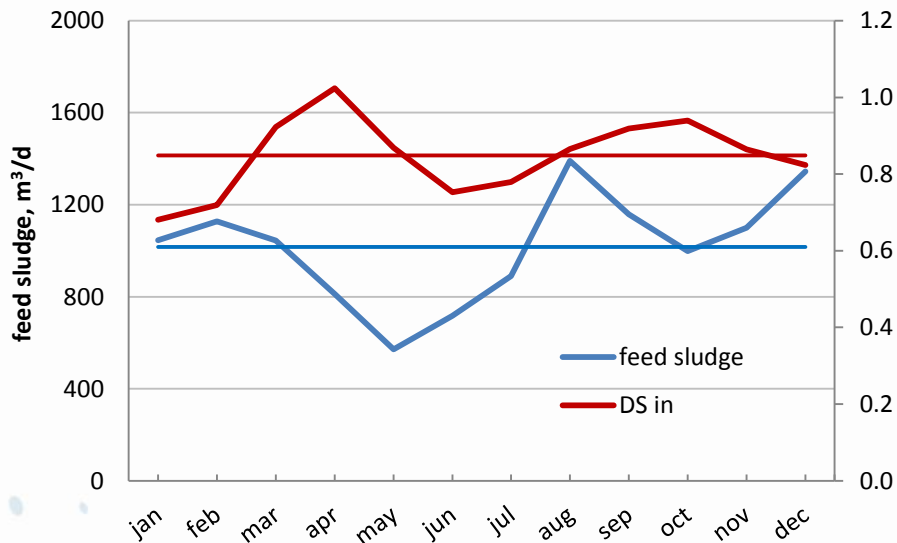
Wastewater and sludge treatment processes



Sludge treatment

- **Thickening** reduces the content of water in sludge to reduce hydraulic load to the digesters and increase the hydraulic retention time (HRT)
 - Primary sludge thickened in belt thickener with polymer to 5-6% of DS
 - Bio sludge thickened in thickening centrifuges with polymer to 5-6% of DS
- **Digestion** for stabilization and hygienisation of sludge, and biogas production
 - Two digesters, at 55° in 16 days – fed in batches to ensure a minimum of two hours exposure time of every sludge particle
- **Dewatering** reduces the content of water in digested sludge to reduce transport costs
 - Dewatering in centrifuges with polymer to about 30% of DS

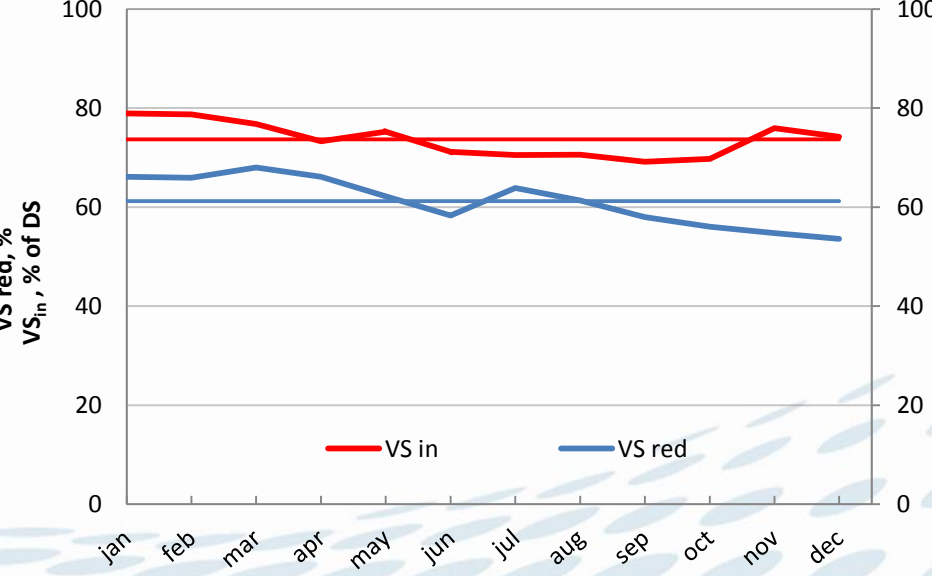
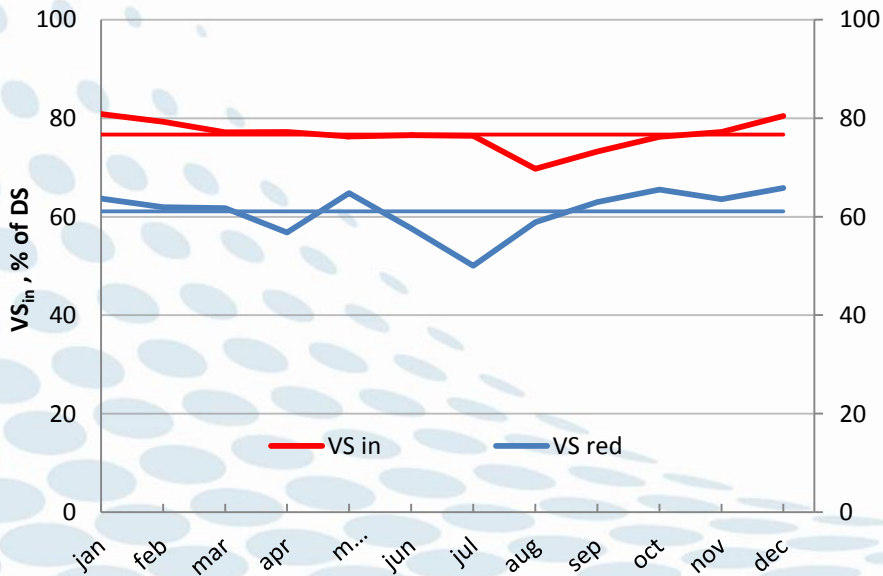
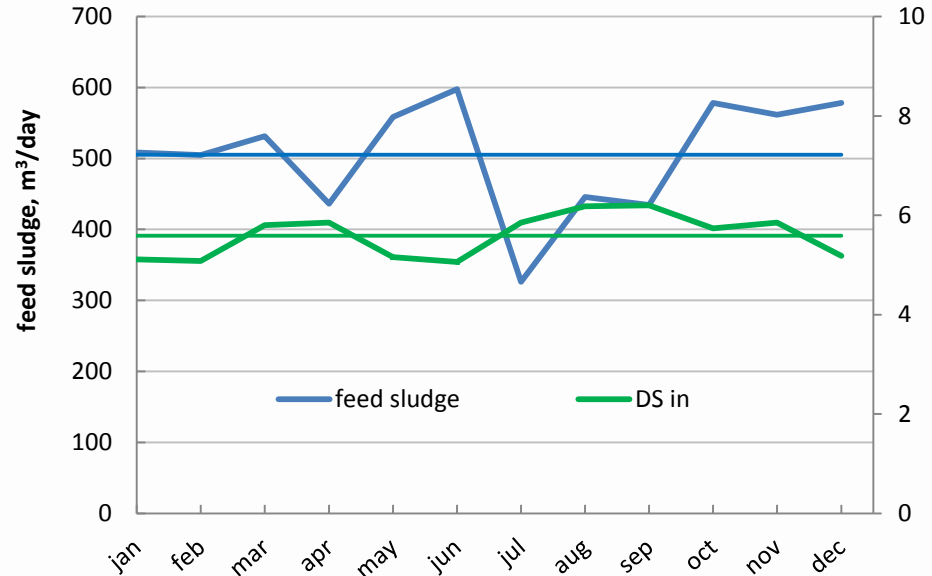
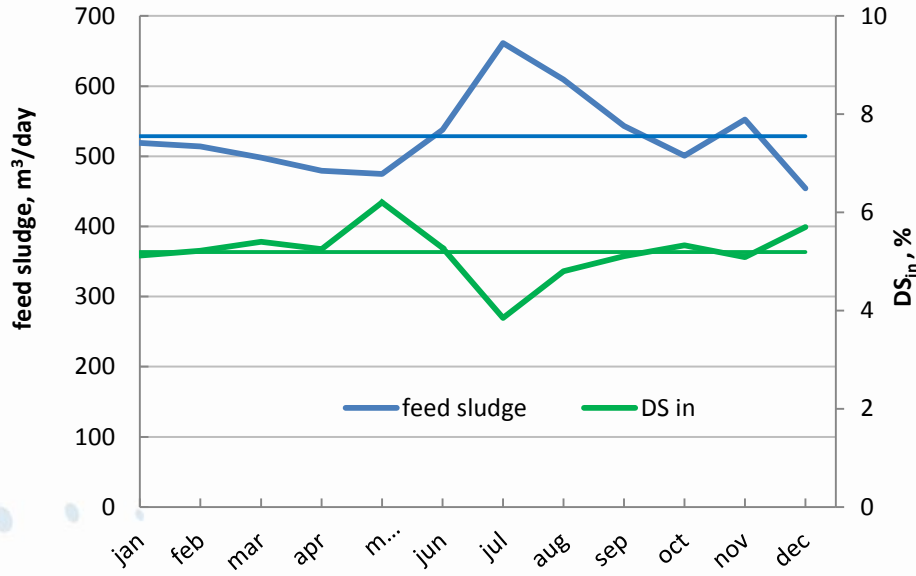
Thickening



Anaerobic digestion

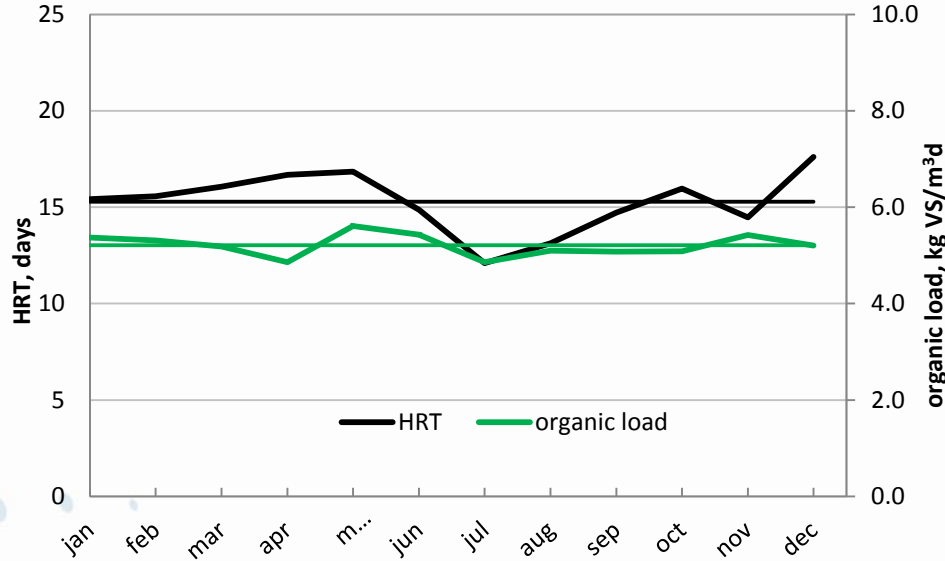
2010

2011

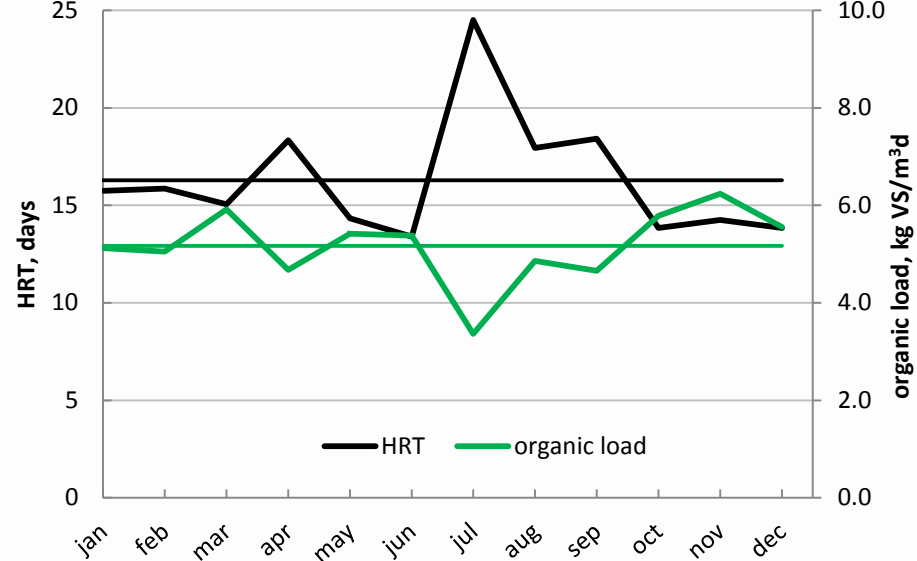


Anaerobic digestion

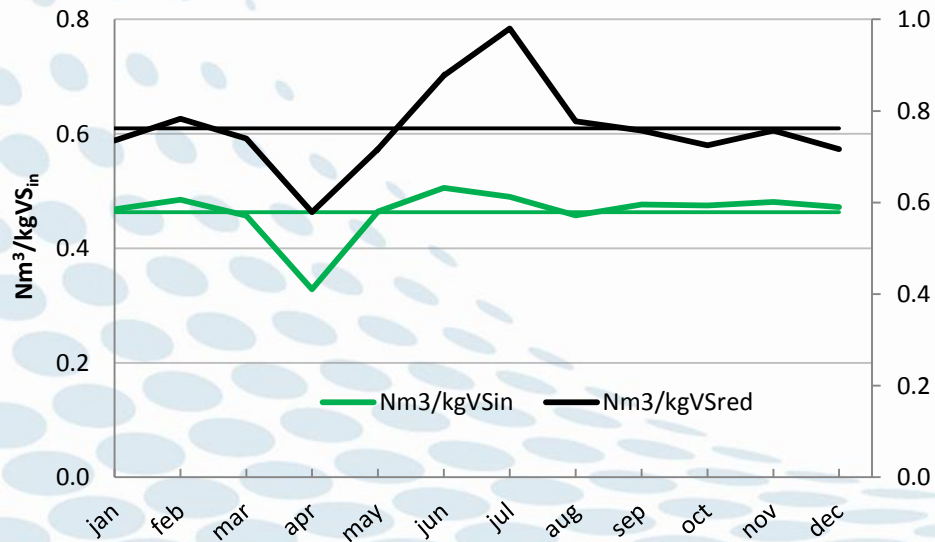
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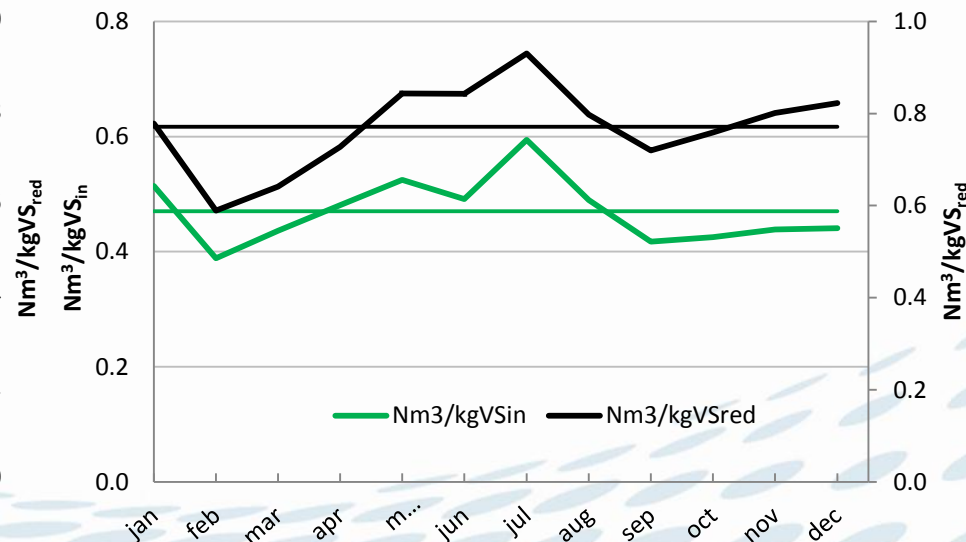
2011



specific biogas production

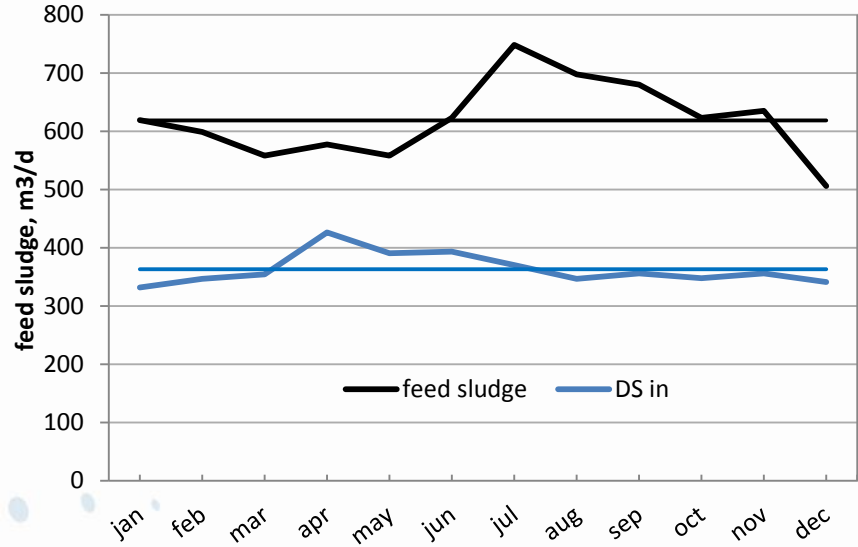


specific biogas production

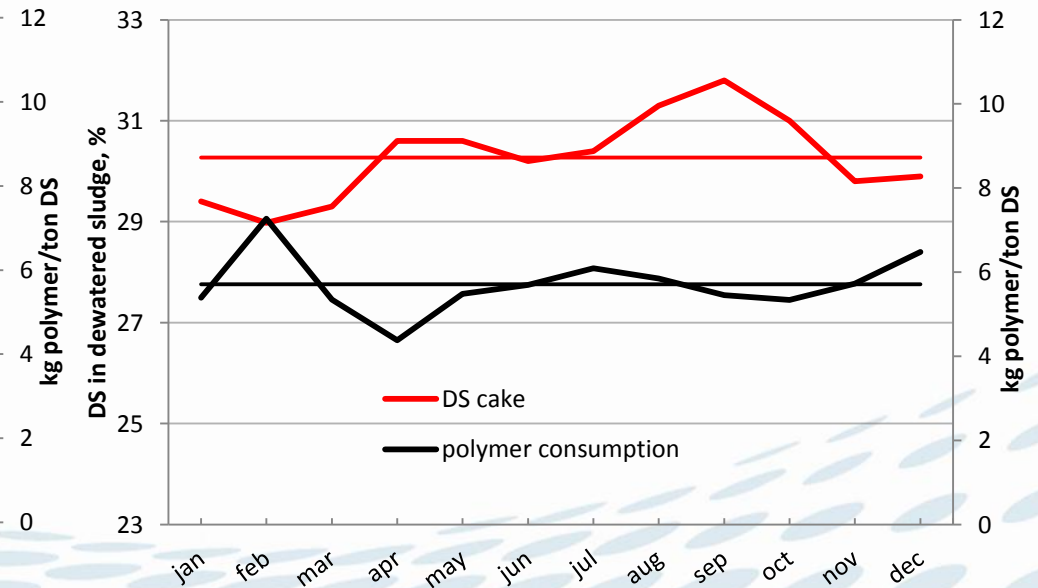
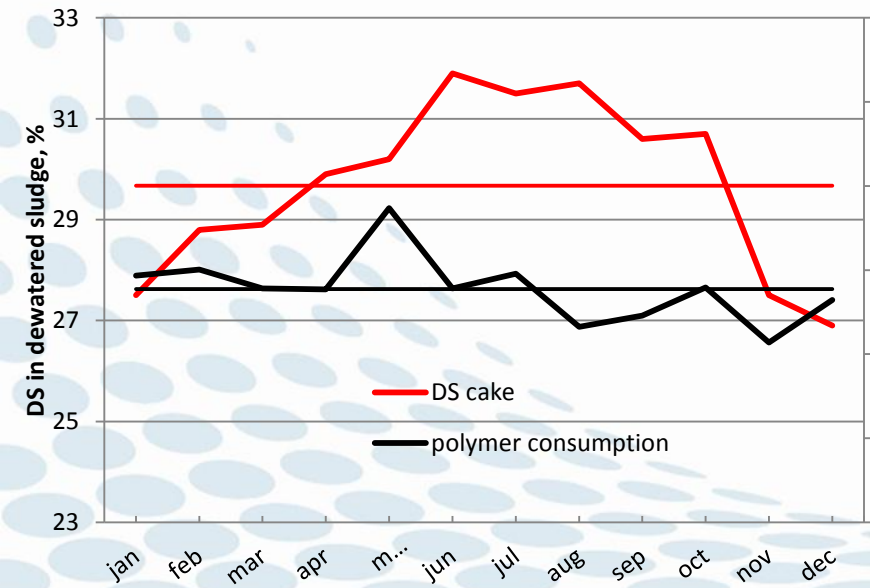
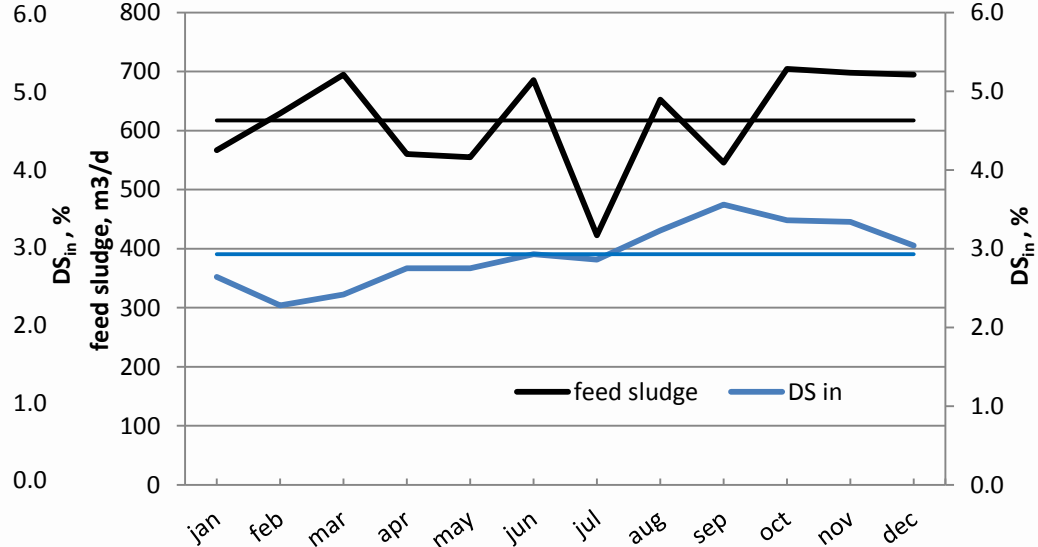


Dewatering

2010



2011



Conclusions

- Bekkelaget WWTP in Oslo, currently treating wastewater from about 290 000pe and producing 5 900 tons DS/year of mixed primary-biological-chemical sludge, has more than 10 years of full scale experience with thermophilic (55°C) digestion.
- The thermophilic operation of anaerobic digesters accomplishes an **efficient and reliable hygienisation** of sewage sludge, provided a semi-batch feeding of the sludge.
- It significantly **increases degradation of organic matter** in sludge resulting in a reduction of the sludge amount for final disposal. A **60% reduction of volatile solids (VS)** has been achieved on an average in the last two years.
- It improves sludge **dewaterability**, with DS content of 30% in dewatered sludge and a polymer consumption of about 6kg/ton DS..
- During the process a **higher production of biogas** can be achieved, making the process more profitable.



THANK YOU FOR YOUR ATENTION!